The Pythagorean Relationship: $a^2 + b^2 = c^2$

MTH1W, Unit 5: Geometry and Measurement, Lesson 6. 75 minutes. Teacher lesson plan.

Lesson at a glance

In every right triangle, the area of the square on the hypotenuse equals the sum of the areas of the squares on the other two sides: $a^2 + b^2 = c^2$. It lets us find a missing side, and it works backwards too: if $a^2 + b^2 = c^2$, the triangle has a right angle, which builders use to check corners.

What students do: Students draw squares on the sides of right and non-right triangles on grid paper, discover the Pythagorean relationship, use it to find hypotenuses and legs (exact and rounded), test whether triangles are right-angled, and learn the carpenter's 3-4-5 check for square corners.

Curriculum expectations

Code	Students will…
E1.5	solve problems involving the side-length relationship for right triangles in real-life situations, including problems that involve composite shapes

From The Ontario Curriculum, Grade 9: Mathematics (2021), MTH1W. A = Mathematical Thinking and Making Connections, B = Number, C = Algebra (C2 = Coding), D = Data, E = Geometry and Measurement, F = Financial Literacy.

Learning goals and success criteria

Learning goals	Success criteria
• We are learning the side-length relationship for right triangles. • We are learning to use it to find missing sides and check right angles.	• I can identify the hypotenuse and legs. • I can find a missing hypotenuse. • I can find a missing leg. • I can test whether a triangle is right-angled.

Materials and preparation

- **Slides:** The Pythagorean Relationship deck.
- **Handouts:** Discover It (page 1), Find the Side (page 2).
- **Tools:** Grid paper, rulers, calculators; a tape measure for the corner check.

Lesson sequence

Time (min)	Part	Teacher	Students	Look for
0–10	**Hook**	Is this corner square?	Discuss.	
10–25	**Discover**	Squares on the sides.	Investigate.	Sees the pattern.

© 2026 K9solutions

Time (min)	Part	Teacher	Students	Look for
25–40	**Use it**	Model; hypotenuse and legs.	Practise.	Correct side as c.
40–65	**Find the side**	Page 2.	Seven problems and a corner check.	Rounds sensibly.
65–75	**Quick check and exit**	Check; exit.	Respond.	

Differentiation

- **Support:** Label a, b and c on every triangle first; use a square-root key.
- **ELL:** Diagram labels: legs, hypotenuse (opposite the right angle).
- **Challenge:** Find three different right triangles with whole-number sides, other than multiples of 3-4-5.

Assessment

Type	Tool	Purpose
Assessment for learning	Discover It and Find the Side	The Pythagorean relationship (E1.5)

Answers: pages 1 and 2

- **Discover:** 3-4: 9 + 16 = 25. 6-8: 36 + 64 = 100. 5-12: 25 + 144 = 169. In each right triangle the two smaller squares add to the largest. Obtuse 3-4 triangle: $c^2 > 25$, so $a^2 + b^2 < c^2$: no match.
- **In my own words:** In a right triangle, the square on the longest side equals the two other squares added together.
- **1. Legs 6 and 8:** $6^2 + 8^2 = 100$: c = 10
- **2. Legs 5 and 12:** 25 + 144 = 169: c = 13
- **3. Legs 7 and 9:** 49 + 81 = 130: c = $\sqrt{130} \approx 11.4$
- **4. Hypotenuse 15, leg 9:** 225 − 81 = 144: b = 12
- **5. Hypotenuse 10, leg 4:** 100 − 16 = 84: b = $\sqrt{84} \approx 9.2$
- **6. Sides 8, 15, 17: right triangle:** $64 + 225 = 289 = 17^2$: yes
- **7. Sides 6, 7, 9: right triangle:** 36 + 49 = 85 ≠ 81: no
- **8. Carpenter:** $60^2 + 80^2 = 3600 + 6400 = 10\,000 = 100^2$. The diagonal should be 100 cm; 99 cm means the corner isn't square (slightly less than 90°).

Teacher notes

- The relationship is named for Pythagoras (Greece, about 500 BCE), but it was known and used much earlier, for example on Babylonian clay tablets, and it appears in ancient Chinese and Indian mathematics.
- The hypotenuse is always opposite the right angle and is the longest side.
- Challenge: 5-12-13, 8-15-17, 7-24-25, 20-21-29.

© 2026 K9solutions

Coming up

Lesson 7, Pythagoras in Composite Shapes.

© 2026 K9solutions